REMARKS

Claims 1 – 5were pending. Claims 1 – 5 were rejected. Claims 2 and 4 are being amended. Claims 1, 3, and 5 are being canceled. Claims 2 and 4 remain pending. Reconsideration is respectfully requested.

Claim Objections

The Examiner objected to claim 4 and 5. Applicants are amending claim 4 accordingly and canceling claim 5. As such, Applicants request withdrawal of the objections.

Claim Rejections – 35 U.S.C. §112

The Examiner rejected claims 1 – 5 under 35 U.S.C. §112. Applicants are canceling claims 1, 3, and 5 and amending claims 2 and 4 accordingly.

The Examiner pointed out that claims 1-5 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the electrochemically active microorganisms as disclosed by Nakamura et al. (US 5.160,604) does not reasonably provide enablement for all possible species of electrochemically active microorganism, and the specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

Also, the Examiner pointed out that the specification at hand makes no specific instruction as to what microorganism (bacteria, fungus, algae, etc.) the invention is to utilize, and further, no working examples are provided in the instant specification so as to enable any ordinary artisan to make and use the claimed invention without undue experimentation to discover workable electrochemically active microorganisms(For instance, Wilkins (1978) measured detectable electrochemical activity successfully from 14 representative species of gram-positive and gram-negative bacteria).

First of all, we are amending the term "electrochemically active microorganism" in the claims to "electrochemically active bacteria" supported by detailed description and Example in specification.

The term of "electrochemically active bacteria" refers to a microorganism which can revive and culture metal salts instead of oxygen under in-water anaerobic conditions, and has

been continuously studied, a representative example of which is "***Shewanella putrefaciens*** (Entrust No.: KCTC 8753P)".

An Fe(III)-reducing bacterium, *Shewanella putrefaciens* is known to localize the majority of its membrane-bound cytochromes on its outer membrane. The outer membrane cytochromes are involved in the reduction of water insoluble Fe(III). Intact cells of anaerobically grown *Shewanella putrefaciens* were electrochemically active and the bacterium could be grown in a fuel cell-type electrochemical cell in the absence of electron acceptor. (See U.S. Patent No. 5,976,719 filed as IDS document together with filing the present application).

That is, it is impossible to describe the electrochemically active bacteria as a defined microorganism such as specific fungi, because the bacteria were electrochemically active by means of their surface having exposed cytochrome on its outer membrane.

The Examiner pointed out that claims 4 to 5 are rejected under 35 U.S.C. 112, second paragraph, because claims 4 to 5 contain reference numerals throughout the body of the claims which seem to refer to some unspecified figure, it is unclear to what, if anything the numerals correspond to. So, with reference to the Examiner's opinion, we cancelled reference numerals in claim 4 and amended the Figure 1 by adding in simple explanation for each body nearby reference numerals.

Claim Rejections – 35 U.S.C. §102

The Examiner pointed out that claims 1, 2, 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Nakamura et al. (US 5,160,604).

That is, Nakamura et al. teaches a method for detecting toxic materials in water using electrochemically active microorganisms, comprising the steps of: determining the stable sensor output as a reference point (Column 4, Lines 12-22), introducing a water sample into the microorganism sensor (Column 11, Lines 20-26), and determining the degree of electrochemical signal changes (Column 11, Lines 27-42).

Applicants submit that Nakamura et al. teaches a toxic substance-detecting system using nitrous acid-producing bacteria, nitric acid-producing bacteria as microorganism source, and dissolved oxygen electrode as electrode.

However, the claimed invention relates to system detecting the changes in the current by using an electrochemically active bacteria as a microorganism source and a microbial fuel cell as a toxic detecting sensor.

Both inventions are clearly different in the kind of microorganisms used. Nakamura et al. uses microorganisms such as a nitrous acid-producing bacteria or a nitric acid-producing bacteria and apply for sensor for the microorganism, whereas the present invention utilizes electrochemically active bacteria contained in various organic substances such as activated sludge.

That is, the present invention is characterized by enrichment culturing the electrochemically active bacteria, because any electrochemically active bacteria having cytochrome exposed on their outer surface, microbial fuel cell and similar structure or suitable work electrode can be used as an electron acceptor. Further, electrons discharged from cytochrome of an electrochemically active bacteria can be absorbed by an anode electrode of microbial fuel cell instead of metal salt exited in the natural world.

Second, there is a difference in the basic structure of the biofuel cells of both inventions. The biofuel cell of Nakamura et al. uses dissolved oxygen electrode being in contact with microorganism membrane, whereas the biofuel cell of the present invention uses microbial fuel cell comprising an anode compartment and a cathode compartment, and the anode compartment acts as a catalyst by attaching an electrochemically active bacteria at the time of entering activated sludge including the electrochemically active bacteria into the microbial fuel cell.

As discussed above, both inventions are highly distinguished from each other in terms of the constitution thereof and the primary features, i.e. the kind of microorganisms and fuel cell used. Therefore, the claimed invention is patentable over Nakamura et al.

Claim Rejections – 35 U.S.C. §103

The Examiner pointed out that claims 1 to 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura et al. (US 5.160,604) in view of Park et al.(US 2001/0026936A1) and Shedd et al. (US 6,058,763).

That is, Nakamura et al. does not teaches the use of a solenoid valve which changes the flow of the sample when entry of toxic materials is sensed, or a sample-gathering vessel which intakes and stores the sample when toxic materials are detected.

However, Park et al. teaches the use of a filter that prevents the entering on non-liquid substances in a sample prior to introducing the sample to wells containing luminescent microorganisms. (Page 2, Column 1, Lines 48-49). Also, Shedd et al. teaches a device for detecting toxic materials in water comprising a solenoid valve (Column 14, Line 1) which changes the flow of the sample when toxic materials are detected (Column 14, Lines 16-25), and a sample-gathering thank which intakes and stores the sample upon detection of toxic substances (Column 11, Lines 12-15).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the instant invention to combine the teachings of Nakamura et al. with the use of a pre-filter to screen out suspended matter and prevent clogging down system. Also, the ordinary artisan would also have recognized that diversion and retention of a contaminated sample would be prudent until further analysis and/or corrective action could be taken.

Applicants submit that as explained above with reference to the §102 rejection, Nakamura et al. does not use a microorganism source and a microbial fuel cell such as the one in the present invention at all. A person skilled in the art cannot easily anticipate the present invention from combining Nakamura et al. with Park et al. (specifically, technology for preventing clogging down system).

In addition, since microbial fuel cells such as the present invention are not described in Shedd et al, it is apparent that a person skilled in the art cannot easily anticipate the present invention from combining Nakamura et al. with Park et al and/or Shedd et al.

In summary, the microbial fuel cell of the present invention can be operated using electrochemically active bacteria contained in activated sludge without the artificial addition of microorganisms. Therefore, since the microbial fuel cell of the present invention does not require the replacement of microorganisms and the use of a separate electron transfer mediator or transducer, it is fabricated in a simple manner and is thus economically advantageous. Therefore, for the above reasons, the claimed invention is patentable over the cited references.

If the Examiner has any questions or needs any additional information, the Examiner is invited to contact the undersigned.

Respectfully submitted,
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In the Drawings:

Please replace the originally submitted drawing sheet containing FIG. 1 with the enclosed replacement sheet containing a revised FIG. 1.